

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 27 OCT 2005

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Applicant's or agent's file reference 4181PTWO/AG/la	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. PCT/EP2004/051437	International filing date (day/month/year) 09.07.2004	Priority date (day/month/year) 09.07.2003	
International Patent Classification (IPC) or national classification and IPC F27D3/18, F27B3/22, C21C5/52			
Applicant DANIELI & C. OFFICINE MECCANICHE S.P.A.			
<ol style="list-style-type: none"> <li>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</li> <li>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</li> <li>3. This report is also accompanied by ANNEXES, comprising:               <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 2 sheets, as follows:                   <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).                    <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.                 </div> </li> <li>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</li> </ol> </li> </ol>			
<ol style="list-style-type: none"> <li>4. This report contains indications relating to the following items:               <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> Box No. I Basis of the opinion                  <input type="checkbox"/> Box No. II Priority                  <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability                  <input type="checkbox"/> Box No. IV Lack of unity of invention                  <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement                  <input type="checkbox"/> Box No. VI Certain documents cited                  <input type="checkbox"/> Box No. VII Certain defects in the international application                  <input type="checkbox"/> Box No. VIII Certain observations on the international application               </div> </li> </ol>			
Date of submission of the demand  27.05.2005		Date of completion of this report  25.10.2005	
Name and mailing address of the international preliminary examining authority:  <div style="display: flex; align-items: center;"> <div>             European Patent Office - P.B. 5818 Patentlaan 2              NL-2280 HV Rijswijk - Pays Bas              Tel. +31 70 340 - 2040 Tx: 31 651 epo nl              Fax: +31 70 340 - 3016           </div> </div>		Authorized Officer  Peis, S  Telephone No. +31 70 340-4265	

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**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2004/051437

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-7 as originally filed

**Claims, Numbers**

1-14 filed with telefax on 27.05.2005

**Drawings, Sheets**

1/3-3/3 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2004/051437

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	1-14
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-14
Industrial applicability (IA)	Yes: Claims	1-14
	No: Claims	

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

**Re Item V.**

**1** The following documents are referred to in this communication:

D1 : US 2003/000338 A1 (V.G SHVER) 2 January 2003 (2003-01-02)

D2 : DE 41 23 391 A1 (Elti S.r.l., Sovere, IT) 23 January 1992 (1992-01-23)

**2 Novelty (Article 33(1)(2) PCT)**

The present application meets the criteria of Article 33(1) PCT, because the subject-matter of independent claims 1 and 11 is new in the sense of Article 33(2) PCT.

Document D1 does not disclose a nozzle having an outlet cross section of a substantially oblong shape and does not disclose explicitly a convergent-divergent nozzle (see however comments in **3.1** about convergent-divergent nozzle in respect of D1). Thus independent claims 1 and 11 are new with respect to document D1.

Document D2 neither discloses a carbon particle injection device set underneath the burner nozzle nor a nozzle with a convergent-divergent shape. Thus independent claims 1 and 11 are new with respect to document D2.

Thus neither document D1 nor document D2 disclose all technical features of the independent claims 1 and 11.

**3 Inventive step (Article 33(1)(3) PCT)**

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of independent claims 1 and 11 do not involve an inventive step in the sense of Article 33(3) PCT.

**3.1** Document D1, which is considered to be the closest prior art, discloses a burner/lance as gas injecting device. From the figures, with reference to the description, it is clear that the burner/lance has a hollow body, an internal tube or pipe for injecting oxygen with a flame shroud from its burner portion and a head with at least one nozzle.

The oxygen-lance is used for injecting oxygen with supersonic velocity (page 6, §[0063]). Either document D1 discloses implicitly a nozzle with a convergent-divergent shape, because no other means could be used, or it is obvious from D1 from the skilled person to use such a convergent-divergent shaped nozzle, because this is the most commonly used nozzle to achieve supersonic velocity of the injected oxygen. Further, document D1 discloses a particulate injector for injecting particulate carbon which is set underneath the burner nozzle (Figure 10, ref. signs 9, 10, 13; § [0066]). The subject-matter of claim 1 and 11 at least differs from document D1 in that the nozzle is of substantial oblong shape whereas according to document D1 it is round.

The technical effect of the difference is that an oblong nozzle spreads the flame which in use can reduce an excessive decarburization within the molten metal or of the layer of dross.

The problem to be solved by the present invention may therefore be regarded as how to uniformise the heat distribution for avoiding of hot spots on the surface area.

However, the oblong shaped nozzle has already been employed for the same purpose in a similar process. Document D2 discloses a burner nozzles (column 3, line 8-55; column 4, line 54-61, figures 1, 4, 6, and 8) with an oblong outlet cross section. It would be obvious to the person skilled in the art, namely when the same result is to be achieved, to apply this feature with corresponding effect according to document D1.

Thus independent claims 1 and 11 do not involve an inventive step (Article 33(3) PCT) regarding the combination of documents D1 and D2.

**3.2** In dependent claims 2-10 and 12-14 slight constructional changes are defined, which are merely one or more of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem posed. Consequently, the subject-matter of independent claims 2-10 and 12-14 also lacks an inventive step.

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

PCT/EP2004/051437

**New claims**

1. A burner and gas-injection device for melting furnaces for melting metal material comprising at least one injector (3) for gas having a hollow body defining a longitudinal axis (20), a first internal pipe (1) and a head (2), fixed to one end of said hollow body, provided with at least one nozzle (4) that sets said first pipe in communication with the outside, the device comprising at least one pipe for injection of carbon (31) in powder form set underneath the nozzle (4) characterised in that the nozzle (4) has at least the outlet cross section (13) of a substantially oblong shape, the nozzle (4) has a convergent-divergent shape.
2. The device according to Claim 1, wherein the divergent portion (18), of the nozzle (4) have cross sections with a progressively more elongated shape in the direction of the outlet cross section.
3. The device according to any of the preceding claims in which the nozzle (4) is coaxial with the cylindrical body.
4. The device according to any of the preceding claims, in which the cross section of the nozzle (4), in the divergent portion has two perpendicular axes of symmetry, the maximum width according to one of said axes, referred to as minor axis (17), remaining substantially unvaried in the passage from said restricted cross section on the outside, the maximum width according to the other axis, referred to as major axis (16) increasing progressively towards the outlet cross section.
5. The device according to any one of the preceding claims, in which the outlet cross section of the nozzle (4) is elliptical, rectangular, or rectangular with the edges rounded off.
6. The device according to any one of the preceding claims, comprising a second pipe (5), set coaxially around said first pipe, and one or more second holes (6) made in the head that set in communication said second pipe (5) with the outside.
7. The device according to Claim 6, in which the second holes (6) are arranged around said nozzle (4), along a circumference concentric with the axis of the nozzle (4).
8. The device according to Claims 4 or 6 or 7, in which said holes (6) are arranged within an angle ( $\alpha$ ), centred on said longitudinal axis and co-planar with a cross section of the nozzle (4), with respect to said minor axis, not greater than  $45^\circ$ ,

preferably not greater than 30°.

9. The device according to Claim 8, in which the second holes (6) are symmetrical with respect to said major and minor axes and define respective axes parallel to the axis of the nozzle (4).

5 10. The device according to one or more of the preceding claims, in which there are provided three injectors (3, 3', 3'') arranged with respective axes substantially parallel and co-planar.

10 11. A method for supplying components to a furnace for melting metal material by means of a device according to any of the preceding claims, comprising the supply of oxygen through the nozzle (4), in which the oxygen is injected in the dross layer, and comprising the supply of carbon through a pipe for injection of carbon, in which the carbon is injected in the dross layer and underneath the pipe for injection of oxygen.

15 12. The method according to Claim 11, in which the outflow of the oxygen through the nozzle (4) is subsonic.

13. The method according to Claim 12, in which the nozzle (4) for the oxygen is set in such a way that the outlet cross section has the maximum width in a substantially horizontal direction.

20 14. The method according to any one of Claims 12 or 13, in which a fuel gas is fed through the second pipes.



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